(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
5 April 2001 (05.04.2001)

PCT

(10) International Publication Number
WO 01/23100 A1

(51) International Patent Classification[7]: B05C 1/08

(21) International Application Number: PCT/US00/26520

(22) International Filing Date:
27 September 2000 (27.09.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
09/408,752 30 September 1999 (30.09.1999) US

(71) Applicant *(for all designated States except US)*: OWENS CORNING [US/US]; One Owens Corning Parkway, Toledo, OH 43659 (US).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: PATEL, Bharat, D. [IN/US]; 829 Melrose Boulevard, Pickerington, OH 43147 (US).

(74) Agents: BARNS, Stephen, W. et al.; Owens Corning Science & Technology Center, 2790 Columbus Road, Building 54-1, Granville, OH 43023-1200 (US).

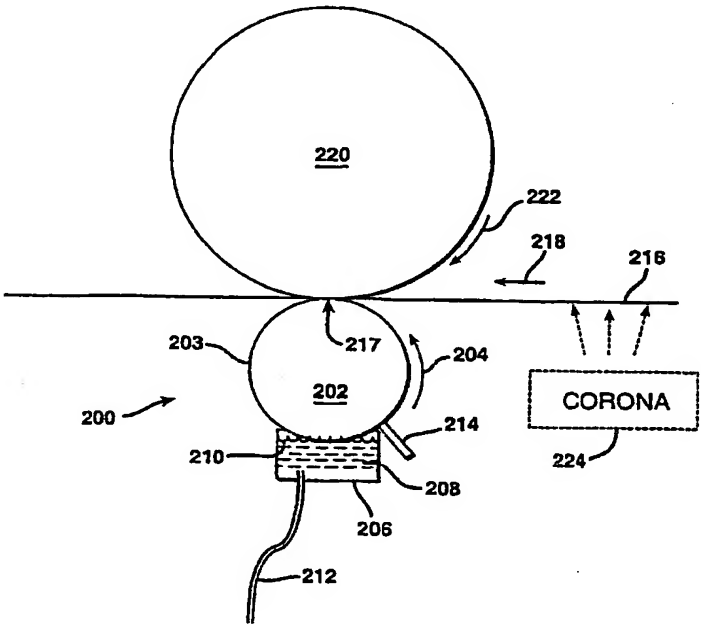
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *With international search report.*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: ROLL ADHESIVE APPLICATION



(57) Abstract: A system for applying adhesive (208) to a facing (216) that will be adhered to a glass wool strip is disclosed. Such a system includes a gravure roll having an image in the form of a pattern (304) etched in the circumferential surface (203), a coating mechanism to apply adhesive to fill the pattern and to prevent adhesive from being presented on non-image areas of the circumferential surface of the gravure roll; and a facing source (217) to pass the facing against the circumferential surface of the gravure so that the adhesive in the pattern is adsorbed by the facing. Another version of the system includes a satellite trough (206) that moves along the circumference of the gravure roll. This permits the system to be adjusted in response to variations in the cure time of the adhesive before it comes into contact with the facing. A Mayer rod (220) is disclosed which may be used in place of a gravure roll. Also disclosed is another system that not only coats the adhesive onto the facing using the gravure roll or Mayer rod, but also then applies this facing to a strip of mineral wool or glass fiber.

WO 01/23100 A1

ROLL ADHESIVE APPLICATION

FIELD OF THE INVENTION

The invention is generally directed toward the field of applying an adhesive to a facing, and more particularly to the field of applying adhesive to a facing using a gravure roll where the facing will later be applied to a strip of glass fiber.

BACKGROUND OF THE INVENTION

In the insulation industry, it is known to adhere a facing to a strip of fibrous insulation. Typically, the fibrous insulation is mineral or glass wool. The facing may be selected from various materials but is typically a kraft paper when the insulation is intended for residential purposes. The adhesive is typically an asphalt which is applied by a roll coater.

A roll coater applies a solid layer of adhesive to the facing in a continuous process. The coated facing is then transported to a laminator that applies the coated facing to the strip of fibrous insulation. The strip is later cut to length to form a batt.

The bulkiness of the roll coating equipment translates to a considerable distance (approx. 10 feet (3.05 meters) or more) between the coating apparatus and the laminator. In many instances, there needs to be another heater (typically, infrared heater) just prior to contact with the insulation batt to promote adhesion. Consequently, such a coating apparatus consumes a great deal of space in a manufacturing facility.

The roll for coating the adhesive on the facing is depicted in Fig. 1. There, a roll or cylinder 102 is arranged in relation to a container 104 that contains liquefied adhesive 106. The roll 102 has a smooth circumferential surface 103 and may be heated. The roll 102 is arranged so that a portion of its circumference is dipped below the surface 108 of the adhesive 106. As the roll 102 rotates in the counterclockwise direction 110, the circumferential surface 103 of the roll 102 is coated with the adhesive 106. The coated surface 103 of the roll 102 comes into contact at a point 122 with a continuous sheet of facing 116 such as kraft paper moving in the direction 118 indicated in Figure 1. Typically, the facing 116 is compressed as it makes contact with the coated circumferential surface 103 of the roll 102 by way of a another roll 120 rotating in a clockwise direction 122.

Two techniques are typically used to control the amount of adhesive coated on to the circumferential surface of 103 of the roll 102. The first technique is to control the temperature of the adhesive 106 in the container 104. As the temperature is increased, the viscosity of the adhesive 106 decreases, so a thinner coating of the circumferential surface 103 is applied. Conversely, if the temperature of the adhesive 106 in the container 104 is decreased, viscosity of the adhesive 106 increases so a thicker coating is applied to the circumferential surface 103.

The second technique, which can be used instead of or in addition to the first technique, involves the use of a metering bar 112. As denoted by the bidirectional arrow 114, the metering bar can be moved closer to, or further from, the circumferential surface 103. The metering bar 112 is oriented so that it scrapes away excess coating carried on the surface 103, resulting in a coating thickness greater than the gap between the end 113 of the metering bar and the circumferential surface 103. As the metering bar 112 is moved closer to the circumferential surface 103, the thickness of the coating is decreased.

Asphalt is typically preferred as an adhesive as it may also serve as a vapor barrier. However, asphalt can be difficult to use, as each batch of asphalt is somewhat different, so the temperature necessary to achieve the desired viscosity, and with it the desired coating thickness, will vary from batch to batch. If the asphalt is coated too thinly on the circumferential surface 103, pin holes can develop, thereby degrading the performance of the asphalt as a vapor barrier.

SUMMARY OF THE INVENTION

It is an advantage of the invention that it provides an alternative to the background art technique of applying asphalt with a smooth roller.

It is an advantage of the invention that it consumes far less adhesive than the background art technique.

The invention has the advantage that it consumes far less space than the adhesive coating technology of the Background Art.

It is an advantage of the invention that the amount of time required for the adhesive to dry is much smaller than for the Background Art.

It is an advantage of the invention that the coating apparatus can be adjusted easily to compensate for changes in the cure time of the adhesive, *for example,* the thermosetting

time or the cross-linking time, that occur because of variations in the adhesive and/or the ambient conditions.

The invention, in part, provides an apparatus for applying adhesive to a facing that will be adhered to a strip of mineral or glass wool insulation. Such an apparatus comprises: a gravure roll having an image in the form of a pattern etched in a circumferential surface thereof; a coating mechanism to apply adhesive to fill said pattern and prevent adhesive from being present on non-image areas of said circumferential surface of said gravure roll; and a facing source to pass said facing against said circumferential surface of said gravure so that adhesive in said pattern is adsorbed by said facing.

The invention also provides, in part, an apparatus for applying a facing to an insulation strip. Such an apparatus comprises: a gravure roll having an image in the form of a pattern etched in a circumferential surface thereof; a coating mechanism to apply adhesive to fill said pattern and prevent adhesive from being present on non-image areas of said circumferential surface of said gravure roll; a facing source to pass said facing against said circumferential surface of said gravure so that adhesive in said pattern is adsorbed onto the surface of the facing; a cylinder, said facing to which said adhesive is adhered passing against the surface of said cylinder; an insulation strip source; and a pinch mechanism to compress the insulation strip at a point at which said facing to which said adhesive is adsorbed by the insulation strip.

The invention also provides, in part, another apparatus for applying adhesive to a facing that will be adhered to an insulation strip. Such an apparatus includes: a Mayer rod having an image in the form of a pattern of wire wrapper helically around a circumferential surface thereof; a coating mechanism to apply adhesive to fill the pattern and prevent adhesive from being present on non-image areas of the circumferential surface of said Mayer road; and a facing source to pass the facing against the circumferential surface of the Mayer rod so that adhesive in the pattern is adsorbed by the facing.

The foregoing and other objectives of the present invention will become more apparent from the detailed description given hereinafter. However, it should be understood that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and

modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic depiction of an apparatus according to the Background Art for coating an adhesive onto a facing.

Fig. 2 is a schematic depiction of a first embodiment of an adhesive coating apparatus according to the invention.

Fig. 3 is a three-quarter perspective of a gravure roll according to the invention.

Figs. 4A-4C are schematic depictions of different configurations of a second embodiment of the coating apparatus according to the invention.

Figs. 5A and 5B are schematic depictions of a combined coating apparatus and facing apparatus.

It is noted that the drawings are not drawn to scale.

DETAILED DESCRIPTION OF THE INVENTION

Fig. 2 is a schematic block diagram of a first embodiment of a coating apparatus according to the invention. The coating apparatus 200 includes a gravure roll or cylinder 202 that spins in the counterclockwise direction 204. The gravure roll 202 is depicted in more detail in Fig. 3. There, the circumferential surface 203 of the gravure roll 202 is depicted as having an image in the form of a pattern of grooves 304 etched into its surface. Pattern, as used herein is not limited to a regular repeated pattern, but may comprise such in a preferred embodiment. Preferably the grooves 304 have a cross-section that provide a large surface area of the adhesive exposed to the facing relative the walls of the groove, such as for example a substantially conical cross-section.

Typically, a gravure roll 202 has a diameter, d, in the range of 6 inches $\leq d \leq$ 12 inches (15.24 centimeters (cm) $\leq d \leq$. 30.48 cm). The depth of the pattern etched into the circumferential surface 203 of the gravure roll 202 is preferably less than or equal to about 1/8 inch (.3175 cm). An alternative, and preferred, form of the gravure roll is a microgravure roll that has a diameter of less than 6 inches, and more preferably a diameter, d, in the range of about 0.5 inch $\leq d \leq$ 3 inches (1.27 cm $\leq d \leq$. 7.62 cm). The depth of the pattern etched into a microgravure roll is preferably on the order of ones of microns, *that is,* a few microns.

The pattern of grooves 304 etched into the circumferential surface of the gravure roll 203 has the advantage that it transfers the adhesive to the facing in a pattern. This pattern is preferably in the form of a cross-hatched or similar pattern having no part that is parallel or perpendicular to the direction 218 that the facing moves. Having a pattern of adhesive, that is, adhesive on less than the entire facing, rather than adhesive covering the entire facing, has the advantage of lowering the flame spread for an insulation product formed of a glass wool batt to which is attached the facing via a patterned coating of adhesive. Also, the consumption of adhesive is reduced.

The apparatus 200 of Fig. 2 also includes a trough 206 that contains adhesive 208. A fluid connection 212 represents a source of the adhesive. The trough 206 is positioned relative to the gravure roll 202 so that the circumferential surface 203 of the gravure roll 202 extends into the trough. This causes a portion of the circumferential surface 203 to dip below the surface 210 of the adhesive 208. As a result, the circumferential surface 203 is coated with the adhesive 208.

Positioned after the trough 206, relative to the rotation 204 of the gravure roll 202, is a doctor blade 214. The doctor blade 214 is disposed very close to the circumferential surface 203. The purpose of the doctor blade 214 is to remove any adhesive from the non-image areas of the circumferential surface. Again, the image is in the form of the pattern of grooves 304 on the circumferential surface 203 of the gravure roll 202. The non-image areas are the smooth, non-etched areas.

It is desired that the adhesive 208 fill only the grooves 304 in the circumferential surface 203 of the gravure roll 202. The doctor blade 214 typically scrapes against the circumferential surface 203, thereby leaving the adhesive only in the grooves 304, *that is,* the image areas. The non-image areas, *that is,* the non-etched areas of the circumferential surface 203, are wiped or scraped substantially clean by the doctor bar 214.

The coated circumferential surface 203 of the gravure roll 202 is brought into contact with a continuous sheet 216 of facing (which is a representation of a source thereof) at a point 217. Preferably, the facing is compressed at the point 217 by an optional, but preferred, roll or cylinder 220 that rotates in the clockwise direction 222. The roll mentioned here is preferably a rubber roll with a Shore A Hardness of no more than 85.

The facing 216 can be foil, co-extruded polymer film, mono-extruded polymer film, paper or foil-skrim-kraft (FSK). Regardless of the material from which the facing is made, it is preferred that the facing is smooth so that the adhesive is adsorbed rather than absorbed.

Such smoothness can be characterized in terms of surface energy relative to water. It is preferred that the surface energy, w, be at least 30 dynes/cm. It is more preferred that the surface energy be at least 35 dynes/cm, more preferably 40 dines/cm, and more preferably in the range of $40 \leq w \leq 42$ dynes/cm. Alternatively, the mechanism of absorption may be used to draw the adhesive to a porous facing, but the absorption will likely require a larger quantity of adhesive.

Preferably the adhesive 218 comprises a polymer adhesive. Preferred polymer adhesive are typically acrylates or epoxies. As a point of reference, the Background Art applies approximately 5 grams per square foot of facing. In contrast, it is possible and preferred according to the invention to apply adhesive to the facing in an amount on the order of tenths of grams per square foot, *that is,* an order magnitude less than the Background Art. It is also possible and more preferable to apply the adhesive in an amount on the order of hundredths of grams per square foot. Although an acrylate or epoxy adhesive is much more expensive than asphalt, the ability to use between about one tenth and one one-hundredth as much acrylate or epoxy as asphalt makes their use more cost effective than asphalt. Alternatively, one skilled in the art appreciates that an asphalt based-adhesive may be used with the present invention using a gravure roll that is heated to apply the asphalt to the facing in a more precisely metered manner.

In a further embodiment, the adhesive 218 can be a 100% solids type of adhesive rather than a solvent-based adhesive such as an acrylate or an epoxy. The use of the 100% solids adhesive is made possible by the short duration of the adhesive in the trough 208. For example, consider two streams of fluid that are combined at different feed rates into an in-stream static mixer (not depicted) located just prior to the trough. The two fluids would most likely be an adhesive base and a crosslinker. A lower bound for the duration in the trough would be about a few seconds (for example, 2 seconds).

Another preferred embodiment utilizes a water-based adhesive. Preferably a system according to the present invention sing such a water-based adhesive, utilizes a small amount of water. Accordingly, the insulation is prevented from becoming excessively wet and a dryer is not required to remove the water from the adhesive, since the small amount of water may be removed from the adhesive as the facing is brought to the strip as described below.

Some techniques can be used to enhance the surface energy and hence the ability to bond to the facing 216. In Fig. 2, an optional corona discharge unit 224 is depicted upstream of the point 217. This permits the corona unit 224 to irradiate the facing 216

before it reaches the point of contact 217 with the coated circumferential surface 203 of the gravure roll 202. Instead of, or in addition to, the corona unit 224, ionic additives or anti-blocking agents are used in the manufacture of the facing.

The ionic additives preferably include an alcohol (primarily in the adhesive), an acrylate (in the adhesive and/or the facing) or maelic anhydride (primarily in the facing). Ionic additives are well known and no further discussion is needed. The anti-blocking agents preferably are acrylic-based. The anti-blocking agents similarly are well known and thus no further discussion is needed. Alternatively, an alcohol or water can be applied as a precoat (in small quantities - by a microgravure roll or by passing through a humidifier chamber) to the facing before the adhesive is applied. This enhances surface energy of the facing.

An alternative to a gravure roll is a Mayer rod. A Mayer rod is a cylinder that has a fine wire wrapped tightly in a helix around its circumferential surface. The wire jacket presents peaks and valleys as an alternative to the etched grooves in the gravure roll. The pattern transferred to the facing is a pattern of slightly diagonal lines. Alternatively, a Mayer rod may use two or more such wires to create an appropriate pattern. In cross section, the Mayer rod appears similar to the gravure roll 202. Hence, Item No. 202 of Fig. 2 can also be said to represent the Mayer rod.

Figs. 4A-4C are schematic depictions of a second embodiment of the coating apparatus according to invention. The primary differences between Figs. 4A-4C and the embodiment of Fig. 2 are the rigid pivotally connected link 406 and the sealing blade 402. The rigid link 406 is connected so as to pivot around the longitudinal axis of the gravure roll 202. The other end of the link 406 is connected to the trough 206. This permits the trough 206 to be moved along the circumferential surface 203 of the gravure roll 202 like an orbiting satellite.

In Fig. 4A, the trough is located directly beneath the point of contact 217 between the coated circumferential surface 203 of the gravure roll 202 and the facing 216. In Fig. 4B, the trough 206 has been rotated 90° clockwise from the position in Fig. 4A. In Fig. 4C, the trough 206 has been rotated 90° counterclockwise from the position depicted in Fig. 4A. With a Mayer rod, instead of roll 220, an arrangement of two rolls (not depicted) on either side of the applicator roll pushing the facing down and forcing the facing to contact the Mayer rod can be used. The tension on the facing controlled by the extent to which these

two rods are pushed down, which also controls the amount of adhesive that will be transferred to the facing.

The sealing blade 402 acts not to scrape off adhesive. Because the adhesive adsorbs well to the facing 216, little to no adhesive remains on the circumferential surface 203 after the point 217 in the counterclockwise rotation 204. Rather, then sealing blade 402 is fitted tightly against the circumferential surface 203 so as to prevent the adhesive 208 in the container 206 from escaping anywhere other than underneath the edge of the doctor blade 214. This is necessary so that when the container 206 is rotated via the rigid link 406 to positions, for example, as depicted in Figs. 4B or 4C, adhesive 208 is prevented from leaking out.

Because the doctor blade 214 and the sealing blade 402 press against the circumferential surface 203 of the gravure roll 202, their temperatures rise due to frictional losses. The adhesive 208 also functions to cool these elements. In addition, there is significant air flow around the coating apparatus to further cool these elements.

The range of motion of the container 206 depicted in Figs. 4A-4C is advantageous because it permits the coating apparatus to be adjusted in response to changes in the curing time, *that is,* the cross-linking or thermosetting time. Of Figs. 4A-4C, the position of the container 206 in Fig. 4B provides the greatest time for the coating of adhesive on the circumferential surface to cure because the arc between the container 206 and point of contact 217, in the direction of rotation 204, is the greatest. Conversely, the arc of rotation in Fig. 4C from the container 206 to the point of contact 217, in the direction of rotation 204, is the smallest. The arc of rotation depicted in Fig. 4A is intermediate between that of Figs. 4B and Fig. 4C. Depending upon the ambient conditions and/or the particular attributes of a batch of adhesive, the coating apparatus can be adjusted by moving the position of the container 206 along the circumferential surface 203 of the gravure roll 202 to provide more or less cure time before the adhesive contacts the facing 216.

Similarly, an advantage of the embodiments of Figs. 4A-4C is that the cure time can be adapted to vary proportionately with changes in the speed of the facing 216.

Fig. 5A is a schematic depiction of a coating apparatus according to the invention in combination with a facing apparatus. The coating apparatus of Fig. 5 has been depicted using the embodiment of Fig. 4A, but the embodiment of Fig. 2 is equally applicable. In Fig. 5, the coating apparatus 400 provides a coated facing 500 in a direction 516 advancing toward a facing apparatus 501.

The coated facing 500 wraps around the roll 512 until it comes into contact at a point 518 with the strip 502 that is moving in the direction. 507. Preferably, the coated adhesive is compressed against a strip 502 via an opposing roll 508 that spins in a counterclockwise direction 510 opposite to the clockwise direction 514 of the roll 512. A heavy line 520 represents the facing 500 adhered to the strip 502. The strip 502 may represent a continuous source of mineral wool or glass fiber, a continuous source of foam (such as extruded polystyrene, expanded polystyrene, polyolefin, or any foam insulation product) or any other low density material.

A roller 503 on a carriage assembly 505 is provided to adjust the length of the path between the coating apparatus 400 and the point 518, that is, to adjust the amount of time before the coated facing 516 reaches the point 518. The roller 503 spins in the clockwise direction 504 and can be moved back and forth in the lateral direction 506 by way of the carriage assembly 505. Fig. 5B depicts the system of Fig. 5A except that the roller 503 has been moved to a different position 530.

Alternatively, the pinching roller of the embodiments can be replaced by a compression plate, or the two rolls mentioned concerning the Mayer rod.

Another advantage of the coating apparatus according to the invention is that it is so small that it can be added to an insulation product assembly line without having to remove an existing coating apparatus according to the Background Art. This has the additional advantage that it is easy to experiment with different patterns on the gravure roll. The gravure rolls themselves are so small as to be easily interchanged. In addition, the coating apparatus can be disabled in order to change the pattern on the gravure roll without disturbing the production line because the coating apparatus according to the Background Art remains in place and can take over temporarily.

Another advantage of the microgravure embodiment according to the invention is the ability to use 100% solids type of adhesive. This type of adhesive is less damaging to the environment than many solvent-based adhesives. Another advantage of the coating apparatus according to the invention is that very little adhesive is used. Of the adhesive consumed, very little is wasted relative to the Background Art.

Epoxies and acrylates are about 20 times more expensive than asphalt. But the gravuring technique according to the invention would permit approximately 100 times less adhesive to be used than in the Background Art. Overall, this is about one tenth as expensive as the Background Art.

As mentioned above, once the adhesive is adsorbed onto the facing, very little drying time is required. For typical speeds of the facing in an insulation batt assembly line, the amount of drying time needed by a coated facing produced via an apparatus according to the invention is in the range of time of about: 0.5 sec. $\leq T \leq 1$ sec.

In a further alternative embodiment, the applicator described herein may be used to apply an adhesive in a manner to provide a vapor barrier. One appreciates that some adhesives may spread when applied to some facings. Accordingly, an adhesive having the appropriate properties may be applied in a manner promoting spread of the adhesive so that a substantially uninterrupted layer of adhesive is present on the facing so as to provide a vapor barrier. One appreciates that the adhesive will thus require the proper viscosity and be applied in the appropriate pattern and environmental conditions. Furthermore, the adhesive must be applied in a volume so as to enable complete coverage and have the appropriate properties to act as a vapor barrier.

The foregoing and other objectives of the present invention will become more apparent from the detailed description given above. However, it should be understood that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

WHAT IS CLAIMED IS:

1. An apparatus (200) for applying adhesive (208) to a facing (216) that will be adhered to a strip of low density material, the apparatus comprising:

a first roll (202) having a pattern (304) in a circumferential surface (203) thereof;

a coating mechanism to apply adhesive to fill said pattern and prevent adhesive from being present on non-pattern areas of said circumferential surface of said first roll; and

a facing source (217) to pass said facing against said circumferential surface of said first roll so that adhesive in said pattern is transferred to said facing.

2. The apparatus (200) of claim 1, further comprising a pinch roll (217) arranged opposite of said first roll (202) to pinch said facing (216) at a point where said facing contacts said first roll.

3. The apparatus (200) of claim 1, further comprising a corona discharge unit (224) to irradiate said facing (216), said corona unit being located at a point along a path of said facing before said facing contacts said first roll (202).

4. The apparatus (200) of claim 1, wherein said first roll (202) has a diameter, d, in the range of about 6 inches $\leq d \leq$ 12 inches (15.24 cm $\leq d \leq$ 30.48 cm) in diameter.

5. The apparatus (200) of claim 1, wherein said first roll (202) is a microgravure roll that has a diameter, d, where d<6 inches (15.24 cm) in diameter.

6. The apparatus (200) of claim 5, wherein said diameter, d, has a range of about 0.5 $\leq d \leq$ 3 inches (1.27 cm $\leq d \leq$ 7.62 cm).

7. The apparatus (200) of claim 1, wherein said coating mechanism includes:

a trough (206) disposed adjacent to said first roll (202) and containing said adhesive (208), said first roll being arranged to be partially dipped in said adhesive contained in said trough; and

a doctor blade (214) arranged adjacent said first roll to remove said adhesive from non-pattern (304) areas of said circumferential surface (203).

8. The apparatus (200) of claim 7, wherein said doctor blade (214) is arranged on a first side of said trough (206), said apparatus further comprising a sealing blade disposed on the opposite side of said trough from said doctor blade, wherein said doctor blade and sealing blade are connected to said trough in such a way as to substantially prevent

adhesive (208) from escaping out of said trough, other than adhesive carried from said trough within said pattern (304).

9. The apparatus (200) of claim 8, further comprising a link (406) pivotally connecting the center of said first roll (202) to said trough (206) such that said trough can be moved along the circumference of said first roll.

10. The apparatus (200) of claim 5, where said adhesive (208) is a 100% solids type of adhesive.

11. The apparatus (200) of claim 1, where said adhesive (208) is a water-based type of adhesive.

12. The apparatus (200) of claim 11, wherein said water-based adhesive (208) is dried without the use of a mechanical dryer.

13. The apparatus (200) of claim 12, wherein said first roll (202) is a microgravure roll that has a diameter, d, where d<6 inches (15.24 cm) in diameter.

14. The apparatus (200) of claim 1, where said adhesive (208) includes an acrylate or an epoxy.

15. The apparatus (200) of claim 14, where an amount of adhesive (208) applied to said pattern (304) is on the order of tenths of grams per square foot.

16. The apparatus (200) of claim 14, where an amount of adhesive (208) applied to said pattern (304) is on the order of hundredths of grams per square foot.

17. The apparatus (200) of claim 1, wherein said pattern (304) etched in said circumferential surface (203) of said first roll (202) has a depth measured radially inward from the surface thereof, the depth being less than or equal to about 1/8 inch (.3175 cm).

18. The apparatus (200) of claim 17, wherein said first roll is a microgravure roll and said depth is on the order of ones of microns.

19. The apparatus (200) of claim 1, wherein said facing (216) is one of foil, co-extruded film, mono-extruded polymer film, paper, foil-skrim-kraft (fsk) or a laminate thereof.

20. The apparatus (200) of claim 1, wherein said facing (216) has a surface energy, relative to water, of at least 30 dynes/cm.

21. The apparatus (200) of claim 20, wherein said surface energy is at least 35 dynes/cm.

22. The apparatus (200) of claim 21, wherein said surface energy is at least 40 dynes/cm.

23. The apparatus (200) of claim 22, wherein said surface energy, w, relative to water, is in the range of about $40 \leq w \leq 42$ dynes/cm.

24. The apparatus (200) of claim 1, wherein said adhesive (208) or facing (216) includes ionic additives.

25. The apparatus (200) of claim 24, wherein said ionic additives includes at least one of an alcohol, an acrylate and maelic anhydride.

26. The apparatus (200) of claim 1, wherein said facing (216) is treated with anti-blocking agents.

27. The apparatus (200) of claim 26, wherein said anti-blocking agents are acrylate - based.

28. The apparatus (200) of claim 1, wherein said pattern (304) is an etched pattern.

29. The apparatus (200) of claim 1, wherein said first roll (202) comprises a Mayer rod (220) and said pattern (304) comprises a wire wound helically around a circumferential surface (203) of said rod.

30. An apparatus (200) for applying a facing (216) to a strip of a low density material, the apparatus comprising:

a first roll (202) having a pattern (304) in a circumferential surface (203) thereof;

a coating mechanism to apply adhesive (208) to said pattern and substantially prevent adhesive from being present on non-pattern areas of said circumferential surface of said first roll;

a facing source (217) to pass said facing against said circumferential surface of said first roll so that adhesive in said pattern is adsorbed by said facing; and

a source of a low density material strip.

31. The apparatus (200) of claim 30, further comprising a pinch mechanism to compress said strip at a point at which said facing (216) to which said adhesive (208) is adhered contacts said strip.

32. The apparatus (200) of claim 31, wherein said pinch mechanism is a first and a second cylinder.

33. The apparatus (200) of claim 30, wherein said low density material is selected from the group consisting of mineral wool fiber, fiberglass and foam.

34. The apparatus (200) of claim 30, wherein said roll comprises a gravure roll and said pattern (304) is an etched pattern formed in said gravure roll.

35. The apparatus (200) of claim 30, wherein said first roll (202) comprises a Mayer rod (220) and said pattern (304) comprises a wire wound helically around a circumferential surface (203) thereof.

36. An apparatus (200) for applying adhesive (208) to a facing (216) that will be adhered to a strip of low density material, the apparatus comprising:

a Mayer rod (220) having a pattern in the form of wire wound helically around a circumferential surface (203) thereof;

a coating mechanism to apply adhesive to fill said pattern.

FIG. 1 PRIOR ART

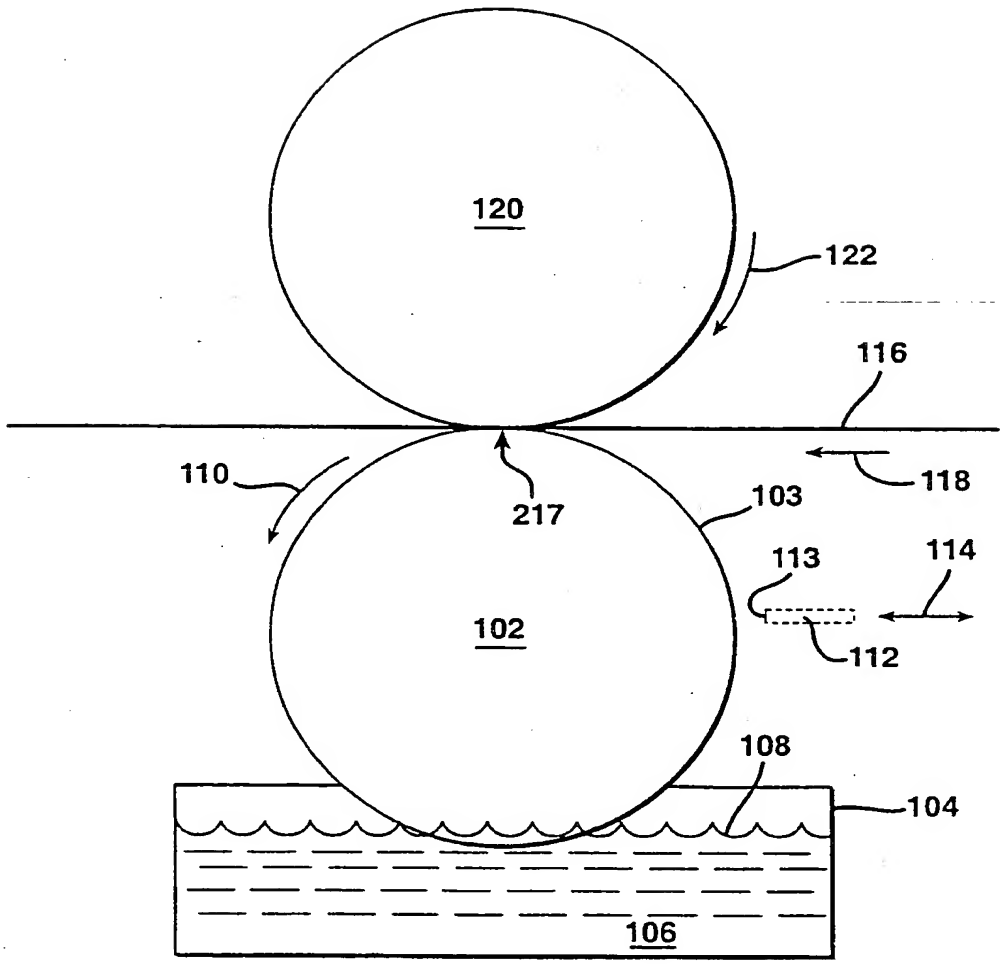


FIG. 2

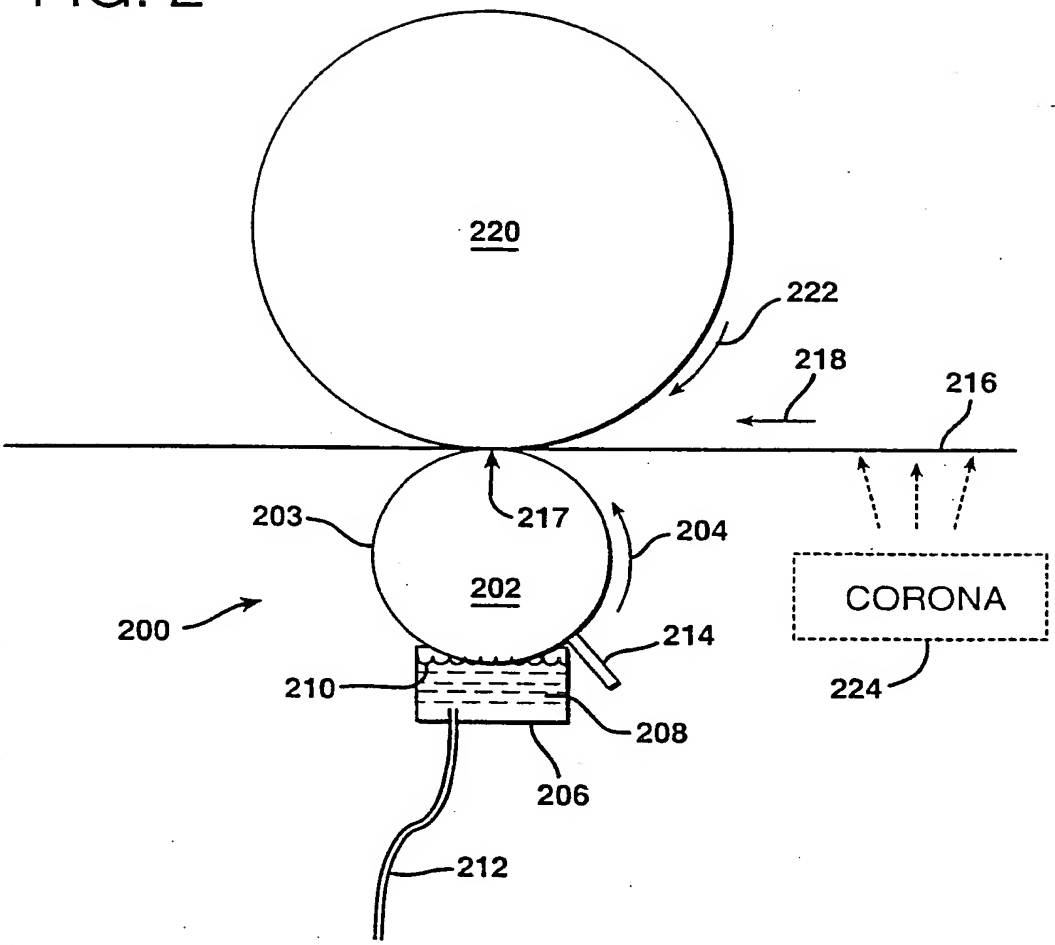

220
222
218
216
203
217
204
202
200
214
CORONA
210
208
224
206
212

FIG. 3

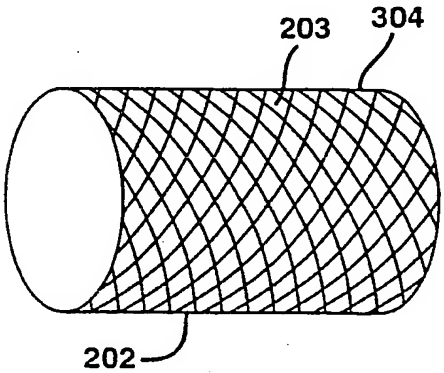

203
304
202

FIG. 4A

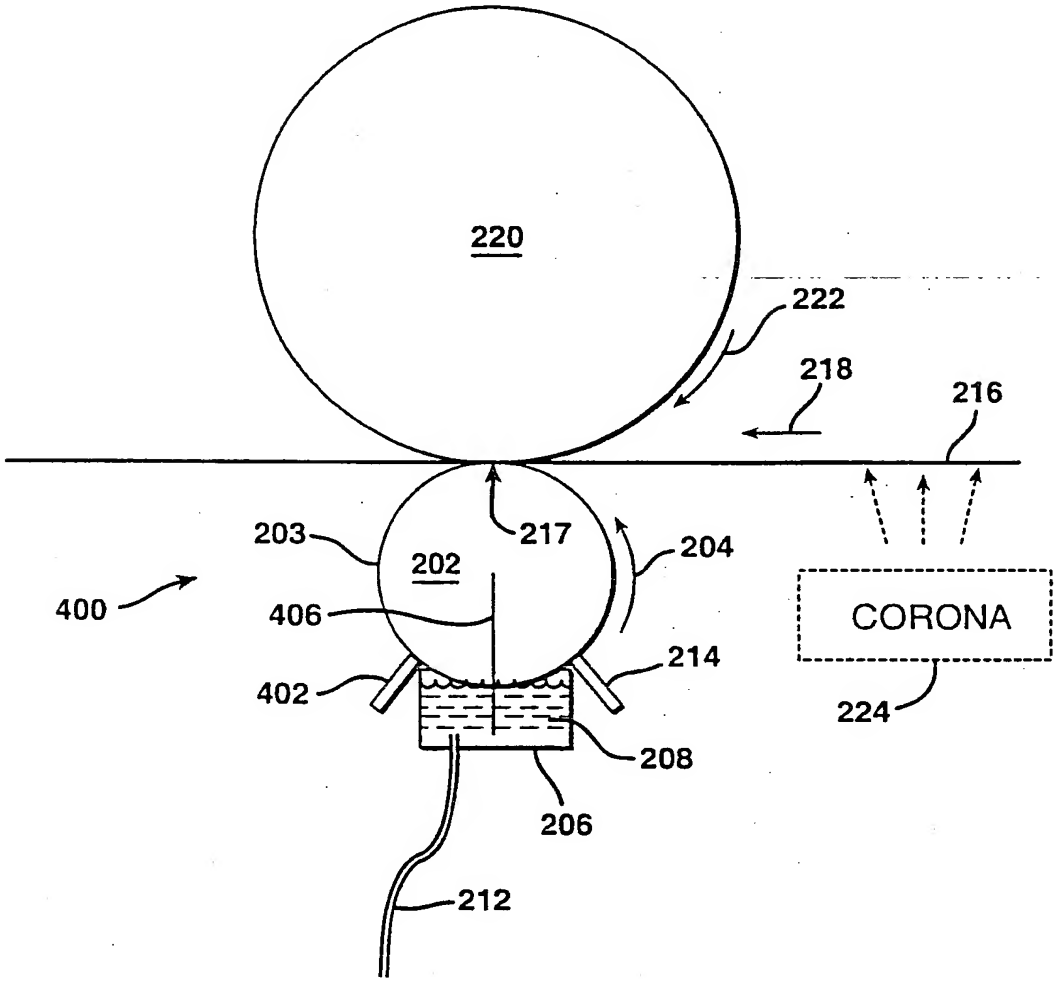


FIG. 4B

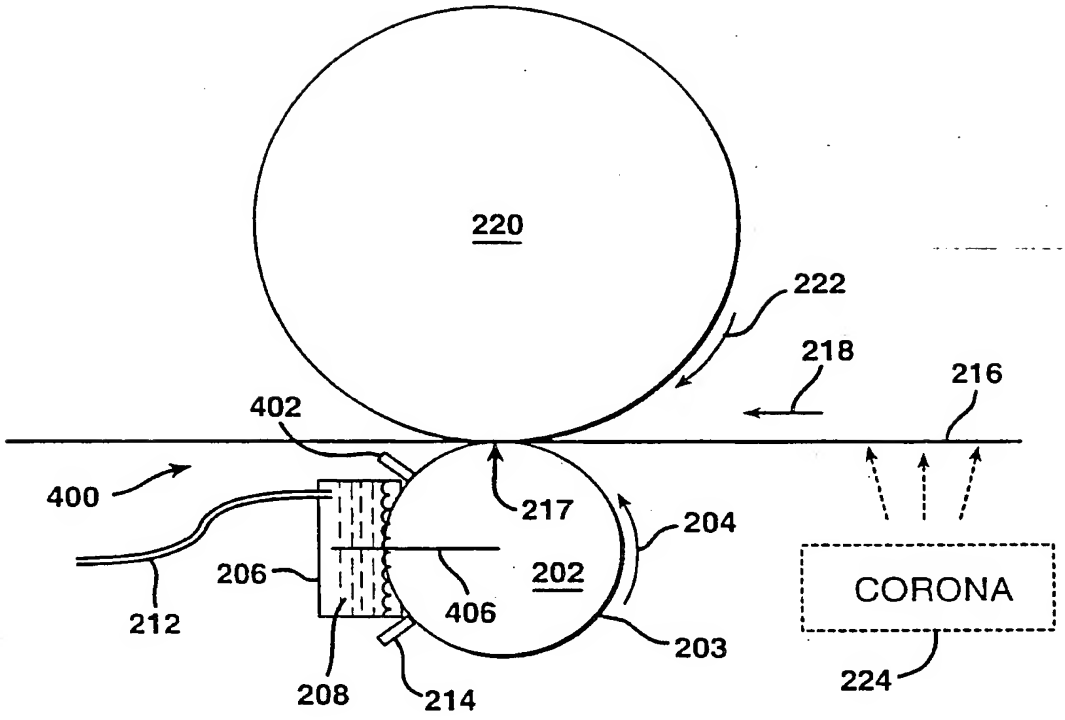

220
222
218
216
402
400
217
204
206
202
CORONA
212
406
203
208
214
224

FIG. 4C

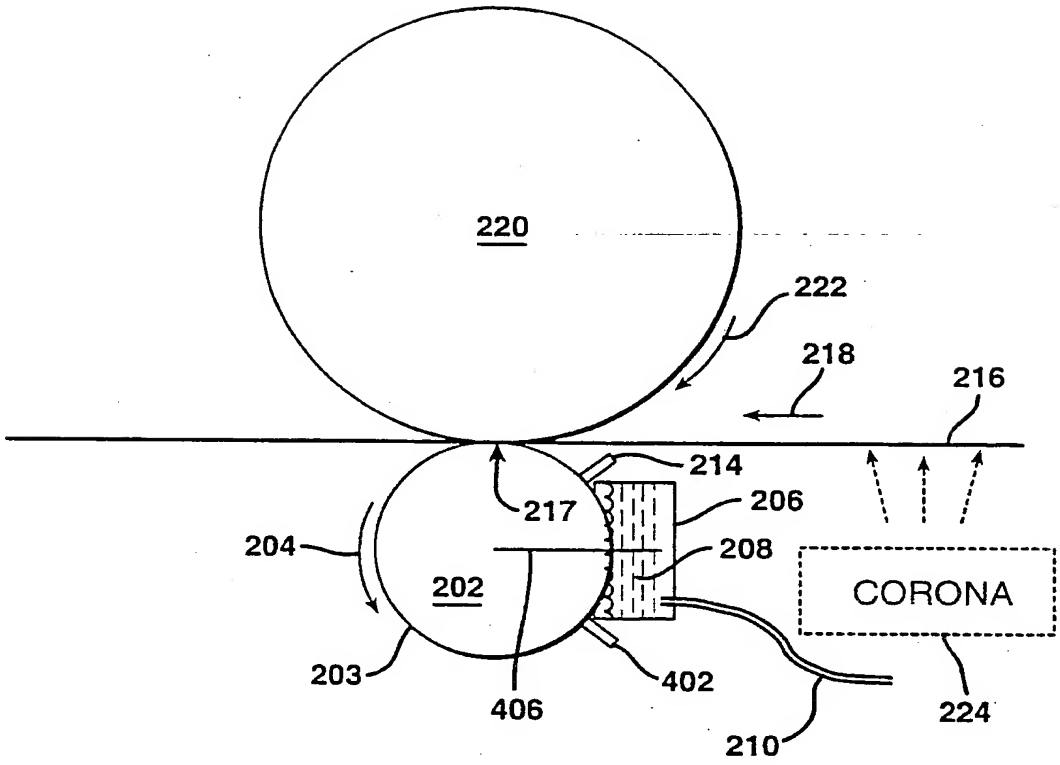

220
222
218
216
214
217
206
204
208
202
CORONA
203
406
402
224
210

FIG. 5A

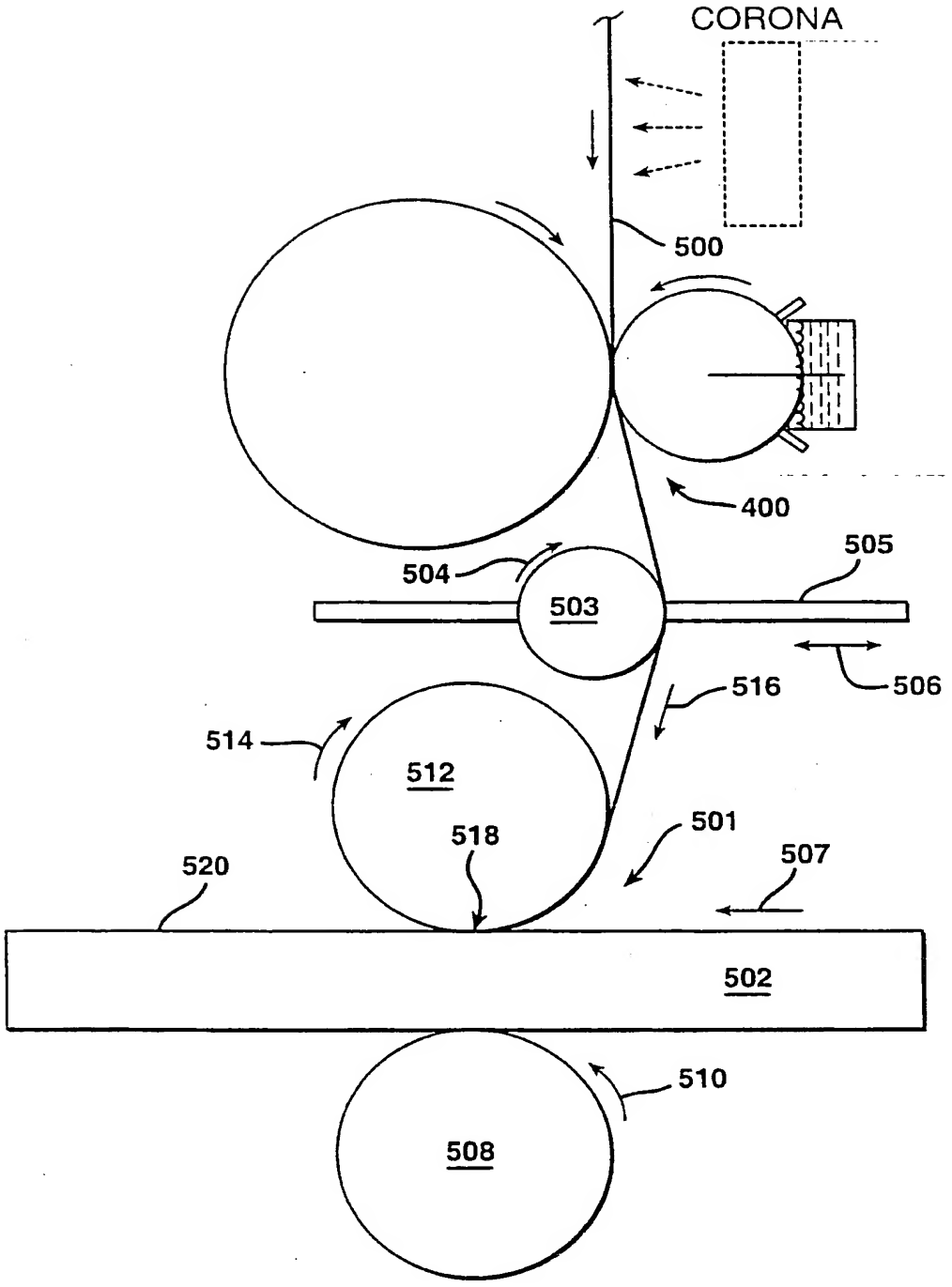
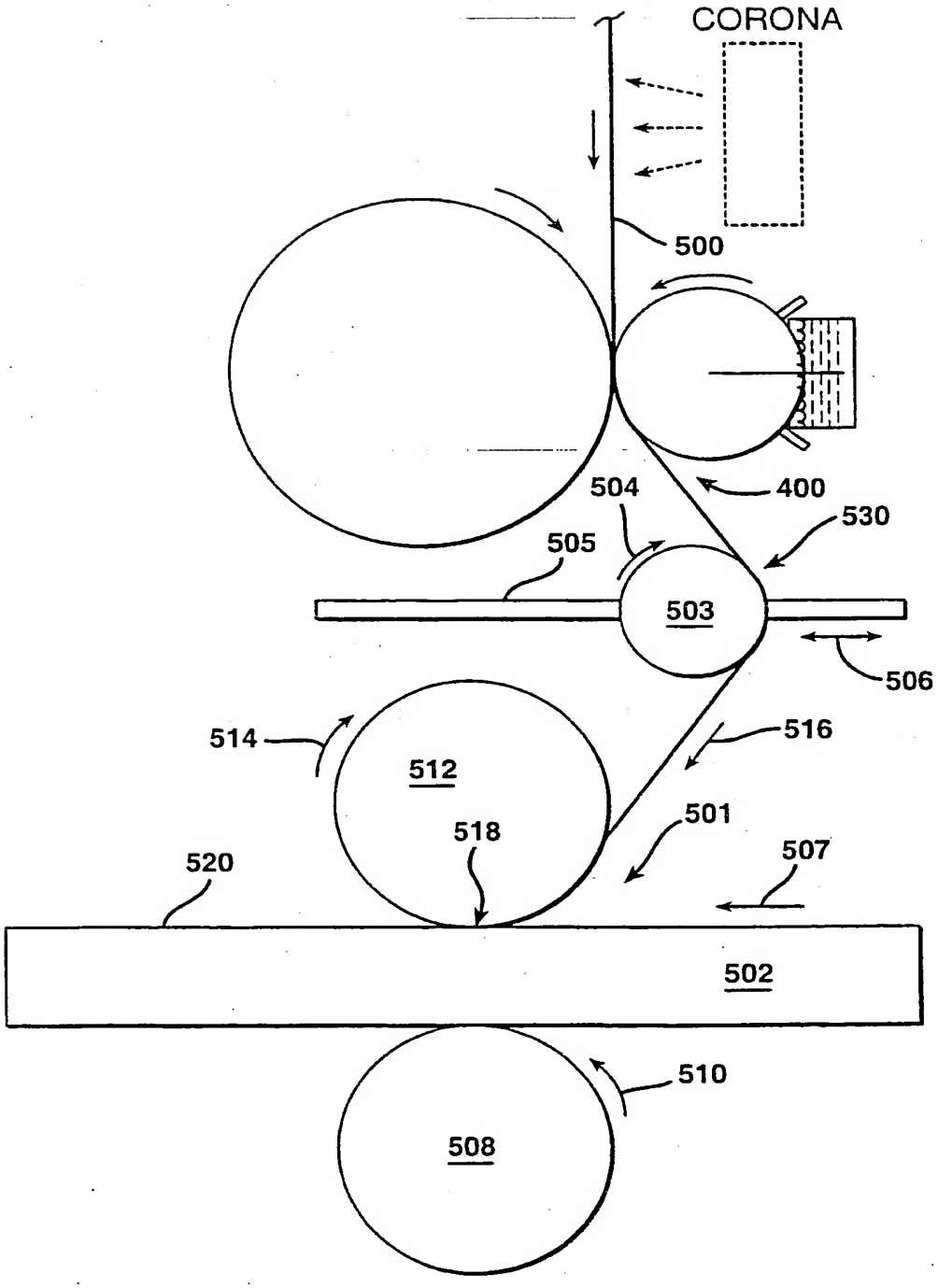


FIG. 5B


CORONA
500
504
400
530
505
503
506
514
516
512
501
518
507
520
502
510
508

INTERNATIONAL SEARCH REPORT

Intern ıal Application No
PCT/US 00/26520

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B05C1/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B05C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2 273 967 A (LEECH R.B.) 24 February 1942 (1942-02-24) page 1, column 2, line 40 -page 2, column 1, line 5 page 2, column 1, line 55-61 figures 1-3,6	1,2,4,7, 11,12, 17,18, 28, 30-32,34
A	---	5,13
X	US 2 787 244 A (HICKIN R.J.) 2 April 1957 (1957-04-02) column 1, line 30-58 column 4, line 50-58 figures 1-3	1,7-9, 11,12, 28,30, 31,34

	-/--	

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 December 2000	22/12/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Lostetter, Y

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Intern ial Application No
PCT/US 00/26520

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 362 174 A (BTG KAELLE INVENTING AB) 4 April 1990 (1990-04-04)	36
A	abstract figures 1,2,4	29,35
A	GB 2 213 406 A (MOLINS PLC) 16 August 1989 (1989-08-16) page 2, paragraph 5 -page 3, paragraph 1 page 13, paragraph 3 page 11, paragraph 5 -page 12, paragraph 1	3,14,19, 20,33
A	GB 1 558 271 A (ICI LTD) 19 December 1979 (1979-12-19) page 4, line 126 -page 5, line 4	26

1

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

Intern al Application No
PCT/US 00/26520

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2273967 A	24-02-1942	NONE	
US 2787244 A	02-04-1957	NONE	
EP 0362174 A	04-04-1990	SE 463078 B	08-10-1990
		AT 88111 T	15-04-1993
		DE 68905991 D	19-05-1993
		DE 68905991 T	28-10-1993
		FI 894576 A	28-03-1990
		JP 2229568 A	12-09-1990
		SE 8803403 A	28-03-1990
		US 5048453 A	17-09-1991
GB 2213406 A	16-08-1989	NONE	
GB 1558271 A	19-12-1979	BE 850463 A	18-07-1977
		CH 604918 A	15-09-1978
		DE 2701236 A	28-07-1977
		FR 2338141 A	12-08-1977
		IT 1065686 B	04-03-1985
		JP 52116308 A	29-09-1977
		LU 76560 A	02-02-1978
		NL 7700207 A	19-07-1977
		US 4147126 A	03-04-1979

Form PCT/ISA/210 (patent family annex) (July 1992)